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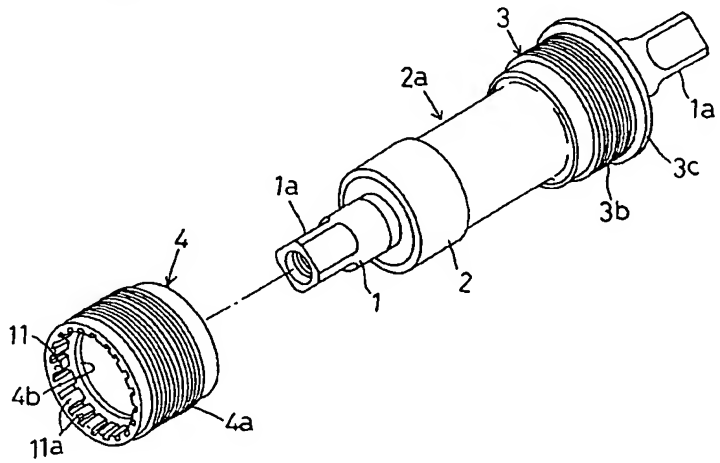
## (54) Crank axle unit for a bicycle.

(57) A crank axle unit mounted in a bottom bracket (5) assembled to a bicycle frame, which crank axle unit has a tubular element (2) surrounding and rotatably supporting a crank axle (1), the tubular element being surrounded by the bottom bracket(5), and a first screw ring (3) and a second screw ring (4) screwed into opposite ends of the bottom bracket (5) for positioning and fixing the tubular element (2) in the bottom bracket (5). The first screw ring (3) is fitted on an outside wall in one end region of the tubular element, and includes a threaded portion (3b) for screwing to an inside wall in one end region of the bottom bracket, and tool engaging teeth (10a) provided on an inside wall at an outward end of the first screw ring. The second screw ring (4) is fitted on an outside wall in the other end region of the tubular element, and includes a threaded portion (4a) for screwing to an inside wall in the other end region of the bottom bracket, and tool engaging teeth (11a) provided on an inside wall at an outer end of the second screw ring. The engaging teeth of the two screw rings are arranged at different pitches, but are engageable with the same tool (12a).

FIG.1

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## Background of the Invention

### Field of the Invention

The present invention relates to a crank axle unit mounted in a bottom bracket assembled to a bicycle frame, and to the technique of positioning and fixing this unit to the bottom bracket. In particular, the invention relates to a crank axle unit comprising a tubular element surrounding and rotatably supporting a crank axle, and a fixing device for positioning and fixing the tubular element in the bottom bracket.

### Description of the Related Art

A crank axle unit as noted above is disclosed in Japanese Utility Model Publication Kokai No. 1989-180394, for example. This crank axle unit includes a first screw ring for fitting to an outside wall of one end region of a tubular element and screwing to an inside wall of one end region of a bottom bracket, and a second screw ring for fitting to an outside wall of the other end region of the tubular element and screwing to an inside wall of the other end region of the bottom bracket. The two screw rings have grooves defined on outer peripheries thereof to act as engaging portions engageable with a screwing tool. That is, the screw rings are turned by a tool acting on the outer peripheries thereof.

According to this construction, these engaging portions have extended axial lengths to allow the screw rings to be turned until the screw rings are screwed into the bottom bracket to extents corr sponding to predetermined lengths for assembly purposes, and to prevent deformation of the engaging portions of the screw rings due to the reaction to turning and tightening of the screw rings to the limits. Consequently, the screw rings project to r latively large extents from the bottom brackets when the screw rings are assembled to the bottom bracket as designed. Front gears and cranks must therefore be located at relatively remote positions laterally of the bottom bracket to be out of contact with the screw rings.

## Summary of the Invention

An object of the present invention is to provide an improved crank axle unit for a bicycle which includes screw rings having tool engaging portions not easily deformable when the screw rings are screwed to required extents into a bottom bracket, with the screw rings extending only slightly, if at all, from the bottom bracket, and an improved technique of assembling the crank axle unit to a bicycle frame.

In order to achieve the abov object, the present inv ntion provides a crank axle unit of the type noted at the outset hereof comprising a first screw ring including a first tool engaging device formed on an inside wall at an outward end thereof, and a second screw ring including a second tool engaging device formed on an inside wall at an outward end thereof.

When screwing the first and second screw rings into the bottom bracket with a tightening tool, the tool acts on the engaging device formed on the inside wall of each screw ring. It is therefore possible even to insert each screw ring completely into the bottom bracket as necessary. This allows front gears and cranks attached to the crank axle to be disposed inwardly toward the bottom bracket, i.e. toward the bicycle frame. Even then, sufficiently large areas of interaction between the engaging devices and tool may be secured to avoid deformation of the engaging devices due to a reaction to the tightening force.

In a preferred embodiment of the present invention, the first screw ring is formed of a metal and the second screw ring formed of plastic, the first and second engaging devices comprising teeth formed on the inside walls of the first and second screw rings, respectively, the pitch of the teeth of the first engaging device being a product of the pitch of the teeth of the second tool engaging device multiplied by an integer (i.e. twice or more). For this crank axle unit, a tightening tool may be prepared which includes opposite teeth arranged on an outside wall thereof at the pitches of the teeth of the second engaging device, the opposite teeth being shaped such that a plurality of opposite teeth fit into a region between adjacent teeth of the first engaging device. Then, although the same tool is used, the second screw ring formed of a weak material may be tightened by means of a force-acting area several times larger than when tightening the first screw ring. This feature allows the configuration of each tool engaging device to be determined in an optimal way where the two screw rings having different material strengths are used.

Other objects and features of this invention will be apparent from the following description made with reference to the accompanying drawings.

## Brief Description of the Drawings

Fig. 1 is a perspective view of a crank axle unit according to the present invention,
Fig. 2 is a sectional view of the crank axle unit in an assembled position,
Fig. 3 is a perspective view of a screwing tool,
Fig. 4 is an end view of a first screw ring,
Fig. 5 is an end view of a second screw ring,
Fig. 6 is an end view of the tool,

Fig. 7 is a schematic development showing a relationship between tool engaging portions of the first and second screw rings and an opposed engaging portion of the tool,
Fig. 8 is a sectional view of the tool, and
Fig. 9 is an end view of the tool.

Detailed Description of the Preferred Embodiment

As shown in Fig. 1, a crank axle unit for a bicycle comprises a unit body including a crank axle 1 and a tubular element 2, and a first screw ring 3 and a second screw ring 4 mounted on opposite ends of the tubular element 2. This crank axle unit is assembled to a bicycle frame by means of a bottom bracket 5 as shown in Fig. 2. The crank axle 1 carries right and left cranks 6a and 6b on opposite ends, and front gears 7 on one end thereof.

The crank axle 1 extends through the tubular element 2 and is rotatably supported therein through balls 8. The crank axle 1 is positioned and retained relative to the tubular element 2 by cooperation of these balls 8 and ring grooves defined circumferentially of the crank axle 1 to receive the balls 8. The opposite ends of the crank axle 1 define crank connections 1a in form of square shafts to which the cranks 6a and 6b are attached for turning together with the crank axle 1. The tubular element 2 defines an annular groove 2a peripherally of an intermediate region thereof for reducing its weight.

The first screw ring 3 includes an annular stopper 3a projecting from an inside wall thereof, and a flange-shaped abutment 3c projecting from an outside wall at an outer end of the first screw ring 3. Further, the first screw ring 3 includes a threaded portion 3b defined over a substantial length peripherally thereof. The first screw ring 3 is fitted to the tubular element 2 to the extent that the stopper 3a contacts an end face of the tubular element 2, and securely fixed to the tubular element 2 such as by press fit. The tubular element 2 is in engagement through the threaded portion 3b of the first screw ring 3 with a threaded portion formed on an inside wall at one end of the bottom bracket 5. The first screw ring 3 is positioned relative to the bottom bracket 5 by the abutment 3c.

The second screw ring 4 securely fitted on the other end of the tubular element 2 defines a threaded portion 4a peripherally and substantially over an entire length thereof to be engageable with an inside wall at the other end of the bottom bracket 5. The second screw ring 4 also includes a stopper 4b projecting inwardly from an inside wall thereof. The stopper 4b is cooperable with an end face of the tubular element 2 to positively maintain the tubular element 2 between the first screw ring 3 and second screw ring 4. That is, the first screw ring 3 fixed to the crank axle unit body is screwed into the bottom bracket 5 from the side at which the front gears 7 are mounted, until the abutment 3c of the first screw ring 3 contacts the end face of the bottom bracket 5. The second screw ring 4 with the inside wall fitted on the tubular element 2 is screwed into the bottom bracket 5 until the stopper 4b contacts the other end face of the tubular element 2. In this way, the crank axle unit is correctly positioned relative to and positively fixed to the bottom bracket 5.

As shown in Fig. 3, the first and second screw rings 3 and 4 include a first and a second engaging portions 10 and 11 defined on inside walls in end regions thereof, respectively, on which a screwing tool 9 acts to screw the two screw rings 3 and 4 into the bottom bracket 5. The first engagement portion 10 includes a plurality of projections or teeth 10a arranged at pitches P1 circumferentially of the first screw ring 3 as shown in Fig. 4. The second engagement portion 11 includes a plurality of projections or teeth 11a arranged at pitches P2 circumferentially of the second screw ring 4 as shown in Fig. 5. The tool 9 has a tubular portion 12 for acting on the screw rings, which includes a plurality of projections or teeth 12a arranged at the same pitches P2 as in the second screw ring 4 circumferentially on an outside wall of the tubular portion 12. When the force-applying portion 12 of the tool 9 is inserted into a bore of the screw ring 3 or 4, the teeth of the force-applying portion 12 enter bottom regions between the teeth of the screw ring 3 or 4, with the teeth of the screw ring 3 or 4 entering bottom regions between the teeth of the force-applying portion 12, thereby the screw ring 3 or 4 may positively be screwed tight with the tool 9. As particularly described later, the pitches and shapes of the teeth 12 of the tool 9 and the teeth 10a and 11a of the two ring screws 3 and 4 are suitably determined, so that the same tool 9, that is the teeth 12a of the same force-applying portion 12 may be used to screw tight the screw rings 3 and 4.

The abutment 3c of the first screw ring 3 must have a small axial length to minimize the extent to which the first screw ring 3 project from the bottom bracket 5 because of the abutment 3c and allow the crank 6b and front gears 7 to be arranged as inwardly as possible. In spite of this, the abutment 3c must have a sufficient strength for position setting through contact with the bottom bracket 5. For this purpose and for securing a sufficient strength in the front gear region, the first screw ring 3 is formed of a metal, for example. On the other hand, the second screw ring 4 which may be less strong than the first screw ring 3 is formed of plastic, for example, to be as light as possible and

manufactured at low cost. The pitch P1 is th product of th pitch P2 multiplied by an integer, so that the number of teeth 11a of the second screw ring 4 corresponds to the product of the number of teeth 10a of the first screw ring 3 multiplied by the integer.

Further, the teeth 10a, 11a and 12a have such shaped that one of the teeth 12a fits into a space between two adjacent teeth 11a while a plurality of teeth 12a fit into a space between two adjacent teeth 10a. This relationship will be described in outline with reference to Fig. 7.

For simplicity, Fig. 7 shows the pitch P1 of the teeth 10a of the first screw ring 3 being twice the pitch P2 of the teeth 11a of the second screw ring 4. In this example, the engagement portion 11 of the second screw ring 4 meshes with the opposite engagement portion or force-applying portion 12 of the tool 9 as an ordinary gear pair. That is, a tooth 12a has a length t1 substantially corresponding to that of a tooth bottom between adjacent teeth 11a, and a tooth 11a has a length S1 substantially corresponding to that of a tooth bottom between adjacent teeth 12a. A tooth 10a of the first screw ring 3 has a length substantially corresponding to the length S1 of the tooth bottom between adjacent teeth 12a. A tooth bottom between adjacent teeth 12a of the first screw ring 3 has a length substantially corresponding to S1 + 2t1 which is the sum of the length S1 of the tooth bottom between teeth 12a and twice the length t1 of a tooth 12a.

Consequently, although the same tool 9, i.e. the same force-applying portion 12, is used, the second screw ring 4 may be tightened by means of larger engagement areas than the first screw ring 3. In other words, use is made of maximum engageable areas available on the respective screw rings 3 and 4. The first screw ring 3 includes only a necessary number of teeth to avoid an undue increase in manufacturing cost and to secure the largest possible distance between adjacent teeth for facility of removal of earth and dust accumulating therein.

Further, in the crank axle unit according to the present invention, one of the threaded portions 3b and 4a of the first and second gear rings 3 and 4 is formed as a right-handed screw and the other a left-handed screw so that the screw rings 3 and 4 do not readily become loose with rotation of the crank axle 1.

The screw rings 3 and 4 are constructed such that the engagement portion 10 or 11 where teeth 10a or 11a are defined has an inside diameter exceeding an outside diameter of an inward end of a boss of the crank 6a or 6b. This construction allows the inward ends of the bosses of the cranks to enter the engagement portions 10 and 11, so that cranks 6a and 6b and front gears 7 are located inwardly with respect to th bicycle frame.

As shown in Figs. 8 and 9, th tool 9 may advantageously comprise a first tightening portion 9a having a hexagon section, a second tightening portion 9b having a track-shaped section, for engaging a wrench or a spanner, and a third tightening portion 9c defining a square bore for engaging a pneumatic screw driver.

## Claims

1. A crank axle unit mounted in a bottom bracket assembled to a bicycle frame, comprising;

   a tubular element surrounding and rotatably supporting a crank axle, said tubular element being surrounded by said bottom bracket, and

   fixing means for positioning and fixing said tubular element in said bottom bracket, said fixing means including; a first screw ring fitted on an outside wall in one end region of said tubular element for screwing to an inside wall in one end region of said bottom bracket, and

   a second screw ring fitted on an outside wall in the other end region of said tubular element for screwing to an inside wall in the other end region of said bottom bracket, and

   characterized in that said first screw ring (3) includes first tool engaging means (10) provided on an inside wall at an end thereof, and said second screw ring (4) includes second tool engaging means (11) provided on an inside wall at an end thereof.

2. A crank axle unit as claimed in claim 1, characterized in that said first tool engaging means (10) and said second tool engaging means (12) have different total areas on which a tightening tool acts.

3. A crank axle unit as claimed in claim 2, characterized in that said first and second tool engaging means (10, 11) comprise teeth (10a, 11a) defined on the inside walls of said first and second screw rings, respectively, said teeth of said first and second screw rings being arranged at pitches in a ratio of one to an integer other than one.

4. A crank axle unit as claimed in claim 3, characterized in that said first screw ring (3) is formed of a metal and said second screw ring (4) is formed of plastic, the pitch of the teeth of said first tool engaging means (10) being a product of the pitch of the teeth of said second tool engaging means (11) multiplied by an integer.

5. A method of positioning and fixing a crank axle unit as claimed in any one of claims 1 to 4, to a tubular bottom bracket fixed to a bicycle frame, comprising the steps of;

fixing to an outside wall in one end region of said tubular element a first screw ring including a threaded outside wall and a first tool engaging portion provided on an inside wall at an outward end thereof,

engaging said tubular element by means of said threaded outside wall of said first screw ring with a threaded inside wall in one end region of said bottom bracket, and

inserting a second screw ring including a second tool engaging portion provided on an inside wall at an outward end thereof, into an annular space formed between an inside wall in the other end region of said bottom bracket and an outside wall in the other end region of said tubular element, with said second screw ring engaging a screw defined on the inside wall of said bottom bracket, said first tool engaging means and said second tool engaging means having different total areas on which a tightening tool acts,

wherein the same tightening tool is used in the above two screwing steps.

6. A tightening tool for positioning and fixing a crank axle unit as claimed in claim 2, to a tubular bottom bracket fixed to a bicycle frame, characterized in that said tool comprises;

first opposite engaging units (11a) arranged along an outside wall thereof, and

second opposite engaging units (11a) arranged along said outside wall and distributed between said first opposite engaging units,

said first and second opposite engaging units being active on said second engaging portion, with said second opposite engaging units active only on said first engaging portion.

7. A tightening tool as claimed in claim 6, characterized in that said first and second tool engaging means comprise teeth defined on the inside walls of said first and second screw rings, respectively, said teeth of said first and second screw rings being arranged at pitches in a ratio of one to an integer other than one, and said first and second opposite engaging units comprise opposite teeth arranged at the same pitches as said teeth of said second engaging portion, said opposite teeth being shaped such that a plurality of said opposite teeth fit into a space between adjacent teeth of said first engaging portion.

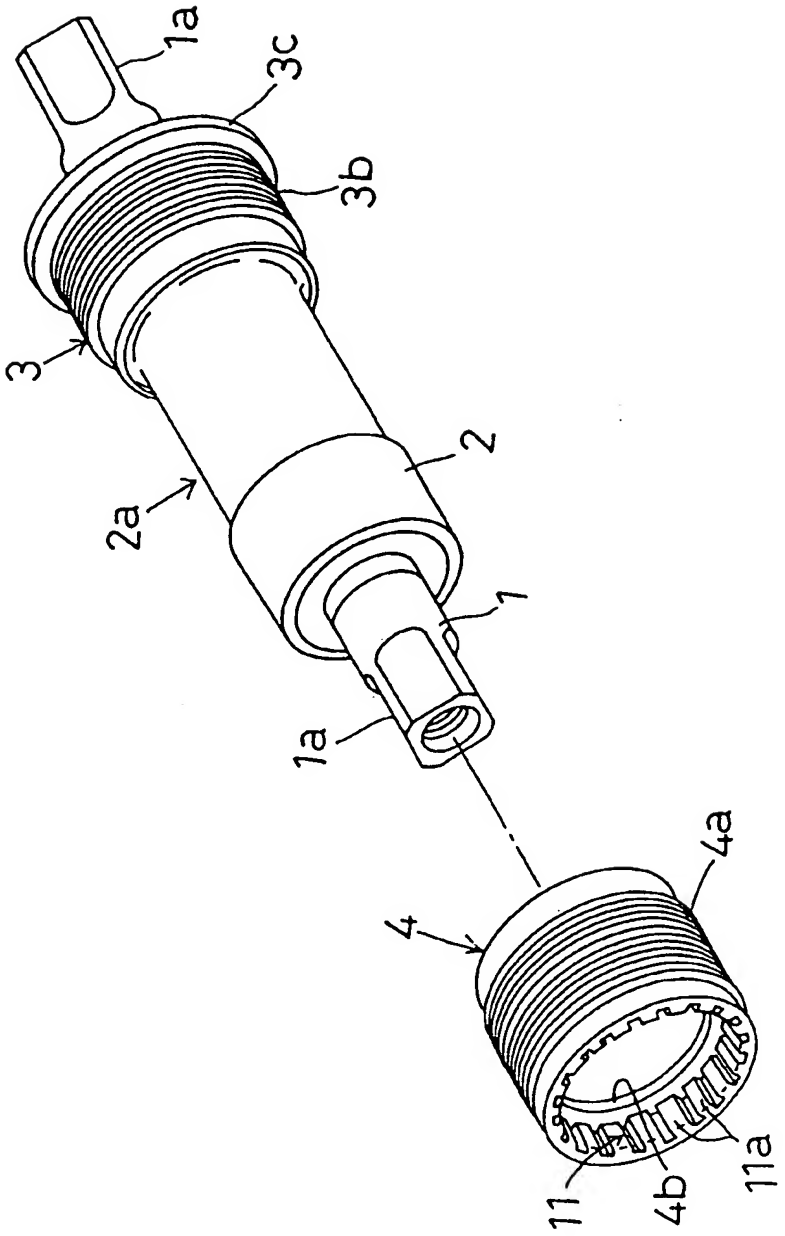
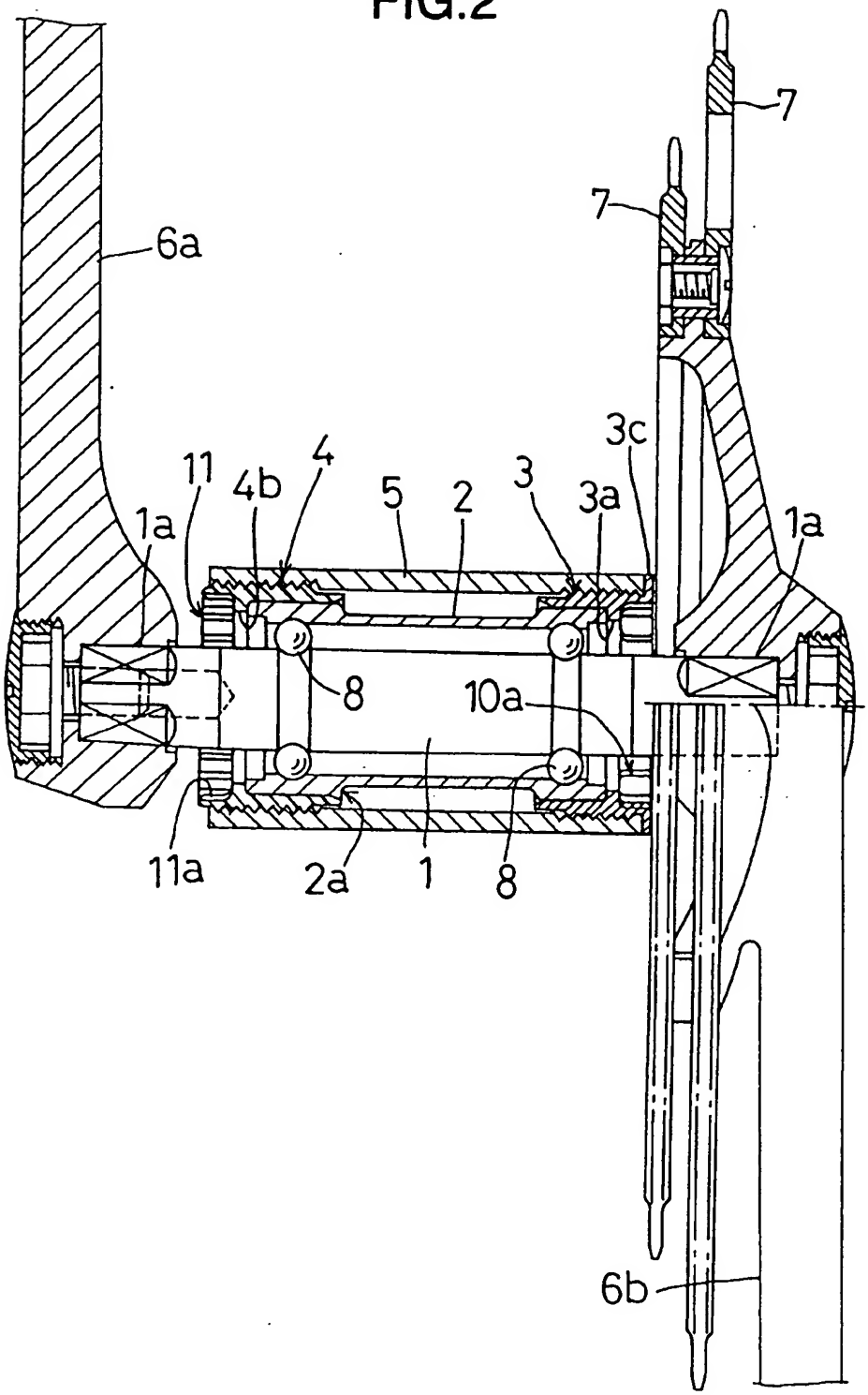



FIG.1

FIG.2



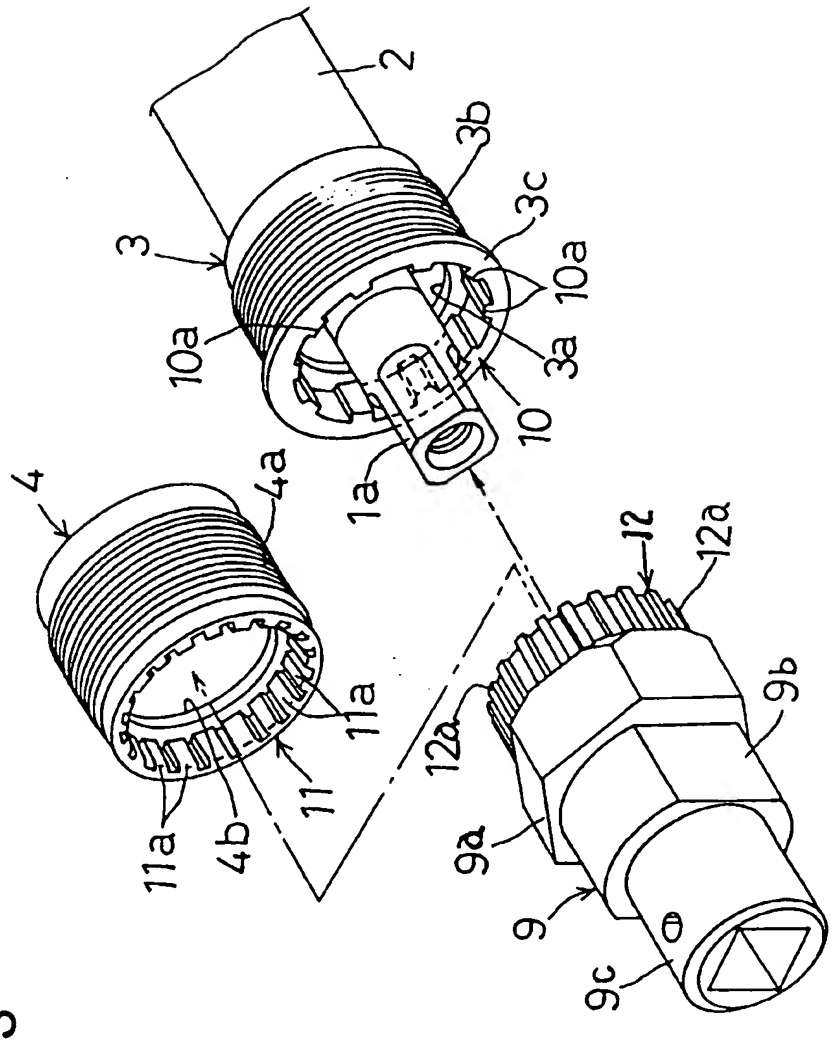



FIG.3

FIG.4

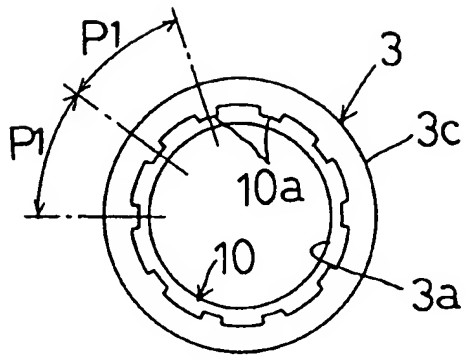



FIG.5

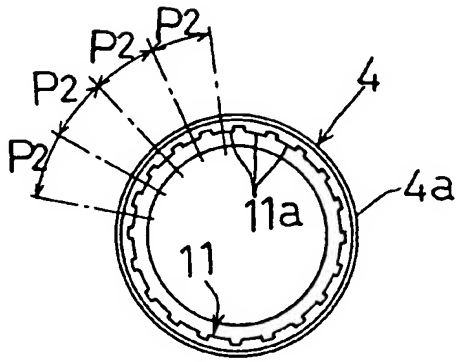


FIG.6

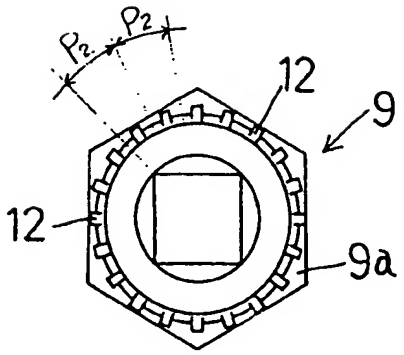



FIG.8

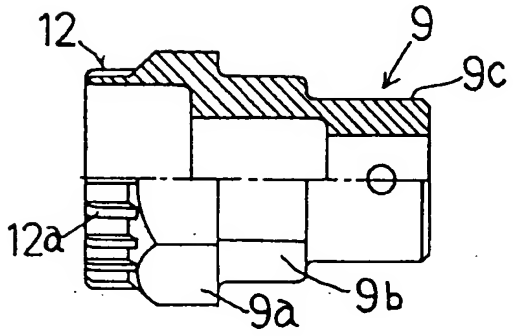



FIG.9

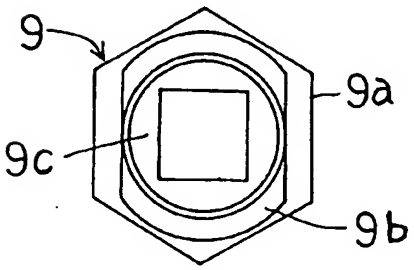
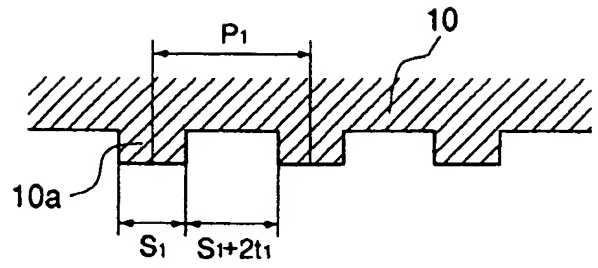
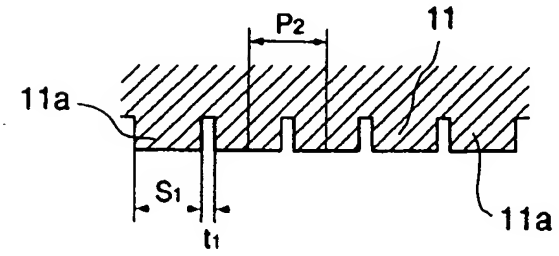
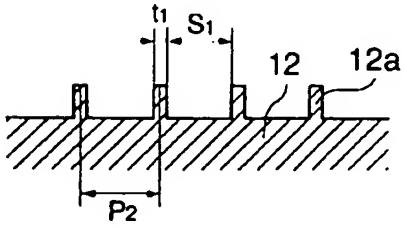


FIG.7



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# EUROPEAN SEARCH REPORT

Application Number

EP 91 10 8733

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl.5) |
|---|---|---|---|
| D,Y | JP-U-1180393<br>* figures 1-5 * | 1 | B62K19/34 |
| Y | GB-A-145153 (L.MCDONALD)<br>* page 3, lines 51 - 57; figures 1, 4 * | 1 | |
| A | FR-A-623094 (FAHRRADWERKE BISMARCK SCHUTTE)<br>* the whole document * | 1 | |
| A | FR-A-2357326 (H.FOLLIET)<br>* the whole document * | 1, 6 | |

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B62K
B62M

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 08 AUGUST 1991 | CZAJKOWSKI A.R. |

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